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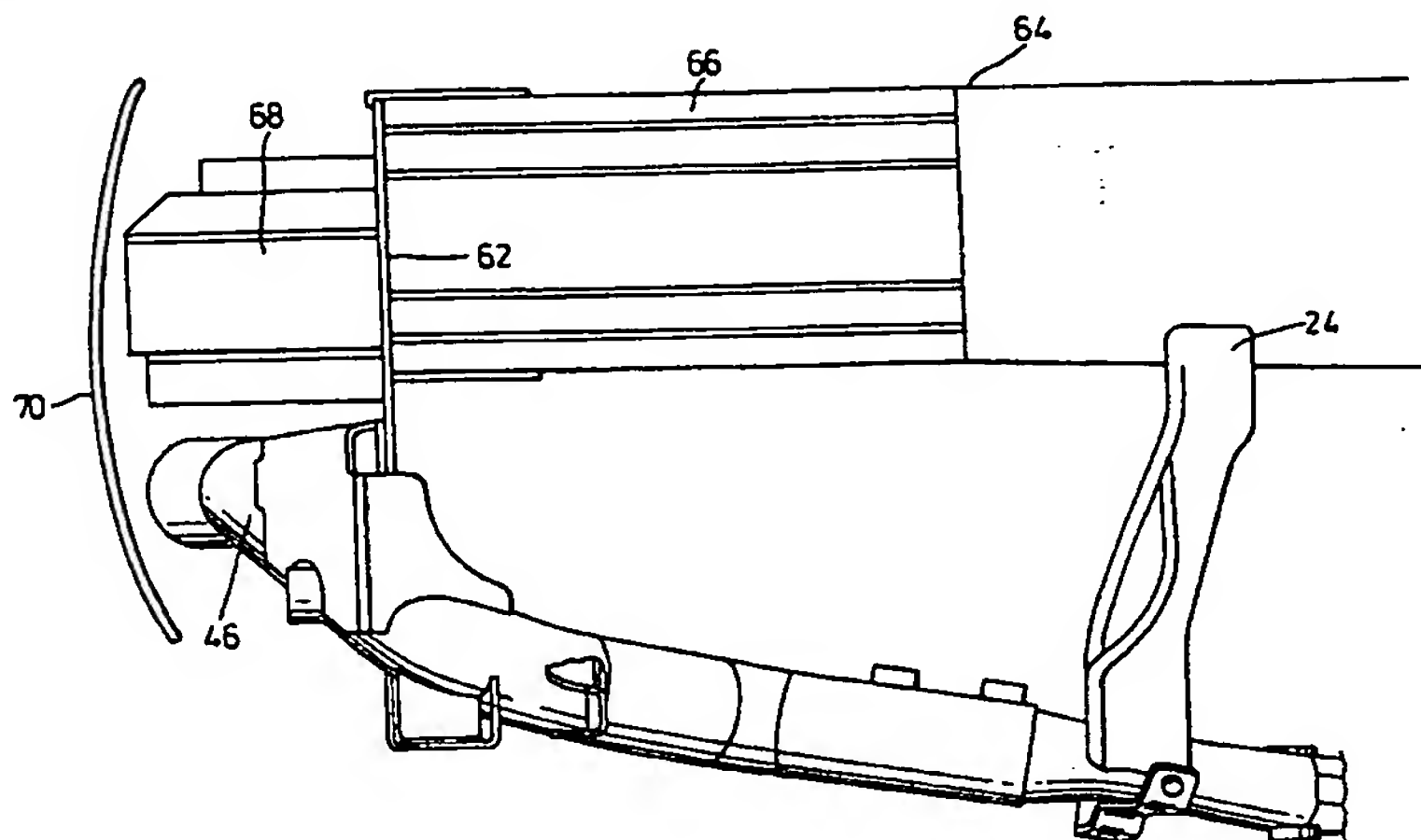
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**(54) Vehicle subframes**

(57) A vehicle bumper assembly comprises a bumper armature 68 and a front portion 46 of a sub-frame both attached by brackets 62 to the front of crumple zones 66 in longitudinal parts of the body structure and to the side sections 48 of the subframe. The sub-

frame front portion 46 is longitudinally level with the armature but vertically below it, and an outer bumper panel 70 covers both the armature 68 and the subframe front portion 46.



**Fig. 3**

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## Description

[0001] The present invention relates to subframes for the front of a vehicle. It is known, for example from GB2235660, US4781398, GB2090795 and DE3522447 to provide a vehicle subframe which carries various components of the vehicle, such as steering and suspension components, and is arranged to deform on impact to absorb energy thereby helping to protect occupants of the vehicle in the event of a crash.

[0002] However the structures disclosed in these documents do not maximize the ability of the subframe to contribute to effective energy absorption, and the present invention aims to improve upon them.

[0003] The present invention provides a vehicle having a body and a subframe mounted on the body and arranged to carry various components of the vehicle, wherein the body includes two longitudinal beams extending substantially parallel to the longitudinal axis of the vehicle, and having their front ends connected to a transverse impact absorbing member, and the subframe includes two longitudinal sections extending substantially parallel to the longitudinal beams and substantially as far forwards, and having their front ends connected to a transverse impact absorbing member.

[0004] Preferred embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a plan view of a vehicle subframe according to a first embodiment of the invention,

Figure 2 is a perspective view of the assembly of Figure 1,

Figure 3 shows the front part of a vehicle including the subframe of Figures 1 and 2,

Figure 4 is perspective view of a subframe and bumper assembly forming part of a vehicle according to a second embodiment of the invention, and

Figure 5 is a side view of part of the assembly of Figure 4.

[0005] Referring to Figures 1 to 3, a vehicle subframe comprises a rear part 10 and a front part 12. The rear part 10 comprises a pair of side sections 14, 16 extending approximately parallel to the longitudinal axis X-X of the vehicle, and a transverse cross beam 18 joined at its ends to the side sections 14, 16 approximately mid-way between their ends. Each side section 14, 16 is attached to the vehicle body at two points: a rear mounting 20 at its rear end 22 and a front mounting 24 at its front end 26. Each front mounting 24 comprises a mounting bracket 28 which has lower end 30 attached to the side section 14, 16 and its upper end 32 attached to the vehicle body.

[0006] The rear part 10 of the subframe therefore forms a rigid H-shaped support, attached to the vehicle body at each corner, to which various components of the vehicle can be attached. Specifically, a suspension arm 34 is mounted on each side section 14, 16 by means of a pair of bushes 36, 38. One of these 36 is approximately level with the rear edge 39 of the cross beam 18, and has a horizontal axis parallel to that of the cross beam 18, and the other 38 is approximately level with the front edge 40 of the cross beam 18 and has a vertical axis. Together the bushes 36, 38 define a pivot axis, extending substantially parallel to the side section 14, 16, about which the suspension arm 34 can pivot, allowing vertical movement of the wheel mounted on it.

[0007] A steering rack 42 is also mounted on the cross beam 18, as is an antiroll bar 44.

[0008] The front part 12 of the subframe is formed from a piece of tubing 45 which is bent so as to form a front portion 46 arranged to extend across the vehicle and two side portions 48 extending rearwardly from the ends of the front portion. Each of the side portions 48 includes a first portion 50 extending outwards and rearwards from the end of the front portion 46 and a second portion 52 extending inwards and rearwards from the rear end of the first portion, which together form a crumple zone in the subframe, and a third portion 54 extending rearwardly, parallel to the longitudinal axis X - X of the vehicle, from the rear end of the second portion 52. At the free end of each of the third portions 54, the tube 45 ends in a straight joint portion 56, which is arranged to be a sliding fit into a joint portion 58 at the front end of the corresponding side section 14, 16 of the rear part 10 of the subframe, just forward of the mounting brackets 28. Aligned holes 60 through the joint portions 56, 58 allow the front and rear parts 10, 12 of the subframe to be releasably bolted together.

[0009] A sheet metal front mounting bracket 62 is welded at its lower end onto the front part 12 of the subframe at each end of the front portion 46 where it joins the front end of the side portions 48. These brackets extend vertically upwards from the subframe and are attached at their upper ends to the front end of respective longitudinal structures 64 in the vehicle body.

[0010] As is shown in Figure 3, the longitudinal structures 64 each have a crumple zone 66 at the front end, the brackets 62 being attached to the front end of the crumple zones. The subframe front part 12 is situated below the longitudinal structures 64.

[0011] A bumper armature 68 is also attached to the brackets 62 above the subframe front portion 46 and level with the longitudinal structures 64. The armature extends across the front of the vehicle substantially parallel to the subframe front portion 46 and above it, the front edges of the armature 68 and the subframe front portion being substantially level along the longitudinal axis of the vehicle.

[0012] An outer bumper member 70 comprising an integral part of a body panel of the vehicle, is situated on

front of the armature 68 and subframe front portion 46, covering them both but spaced slightly away from them.

[0013] The front mounting points 24 of the rear part 10 of the subframe are attached to the longitudinal structures to the rear of the crumple zones 66.

[0014] In the event of a frontal impact with, for example, a pedestrian, the load of the bumper assembly on the pedestrian, and hence also the load of the pedestrian on the bumper assembly, provided that load is sufficient to deform the outer bumper panel 70, is spread between the armature 68 and the subframe front portion 46. This spreading of load can help to reduce injury to the pedestrian.

[0015] Also the energy of the impact received both by the armature and the subframe front portion 46 is transmitted by the brackets 62 into the crumple zones 66 in the body and those 50, 52 in the subframe side portions 48 which can therefore crumple together to absorb the impact energy whilst being held in a parallel relationship to each other by the brackets 62. Because the subframe extends forwards to the front of the vehicle, level with the bumper armature and the front ends of the body longitudinal structures 64, it is effective in absorbing impact energy from almost the moment of impact.

[0016] Referring to Figures 4 and 5 a second embodiment of the invention is similar to the first, with corresponding parts given the same reference numeral preceded by a 1. The difference with the second embodiment is that the front portion 46 of the subframe is omitted, and the front ends of the two side portions 148 are bolted onto the bottom ends of the front mounting brackets 162 on which the bumper armature 168 is mounted. The bumper armature therefore takes all of the load in a frontal impact, but this load is still reacted back through the subframe side portions 148 and the longitudinal body structures 164 in parallel. Because the subframe side portions 148 and the longitudinal body structures 164 are substantially parallel to each other and the brackets 162 connect them both rigidly to the bumper armature 168, in the event of a frontal impact they deform by crumpling simultaneously whilst remaining substantially parallel with each other. The subframe therefore contributes significantly to the energy absorbing capability of the overall structure which is stiffer than if either the body structure 164 or the subframe 110 acted alone to absorb the energy.

### Claims

1. A vehicle having a body (64) and a subframe (10, 12) mounted on the body and arranged to carry various components (34, 42, 44) of the vehicle, wherein the body includes two longitudinal beams (64) extending substantially parallel to the longitudinal axis (X - X) of the vehicle, and having their front ends connected to a transverse impact absorbing member (68), characterized in that the subframe includes two longitudinal sections (14, 16, 48)

extending substantially parallel to the longitudinal beams and substantially as far forwards, and having their front ends connected to a transverse impact absorbing member.

2. A vehicle according to claim 1 wherein the longitudinal subframe sections (14, 16, 48) and the longitudinal beams (64) are both connected at their front ends to the same transverse impact absorbing member (68).
3. A vehicle according to claim 2 wherein the transverse impact absorbing member (68) comprises a bumper armature.
4. A vehicle according to claim 2 or claim 3 wherein the front end of each of the longitudinal beams is connected to the front of a respective one of the longitudinal subframe sections by means of a rigid bracket (62) and the transverse impact absorbing member (68) is attached to the brackets.
5. A vehicle according to any foregoing claim wherein the subframe further comprises a cross beam (46) which forms the transverse impact absorbing member to which the front ends of the longitudinal subframe sections are attached.
6. A vehicle according to claim 5 when dependent on claim 3 wherein the cross beam (46) extends substantially parallel to the bumper armature (68) and is positioned substantially level with it in the longitudinal direction of the vehicle.
7. A vehicle according to any foregoing claim wherein the longitudinal subframe sections comprise front portions (48) and rear portions (14, 16), the front portions (48) are arranged to deform before the rear portions (14, 16) in the event of a frontal impact of the vehicle, and the front portions are detachable from the rear portions to enable replacement of the front portions.
8. A vehicle according to any foregoing claim wherein the subframe (10, 12) is resiliently mounted on the body (64) and arranged to isolate the body from vibration of said components.
9. A vehicle according to any foregoing claim wherein said components include at least one of a steering assembly (42), an anti-roll bar (44) and a suspension arm (34).
10. A vehicle according to any foregoing claim wherein the subframe (10, 12) is mounted below the longitudinal beams (64).

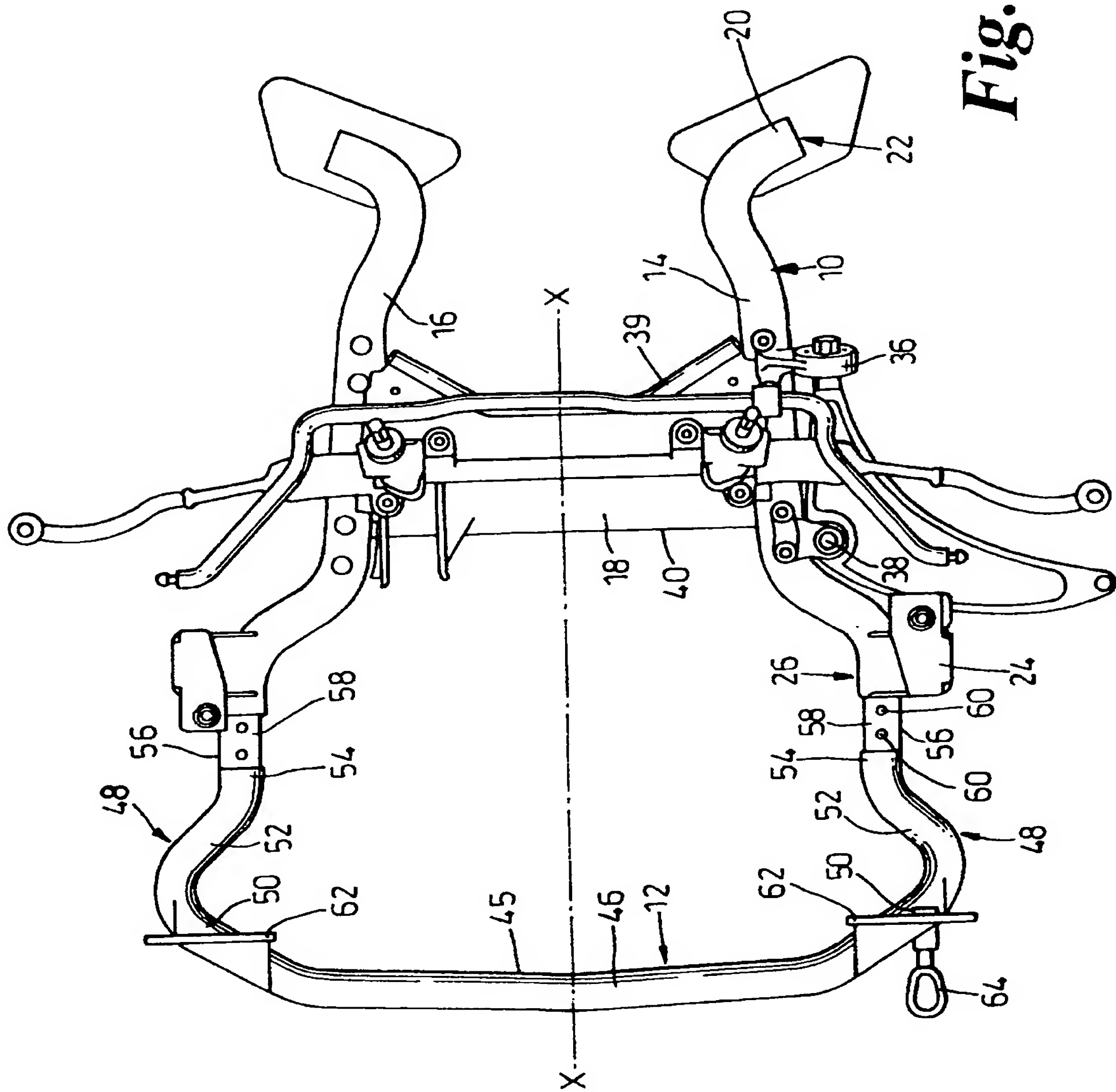


Fig. 1

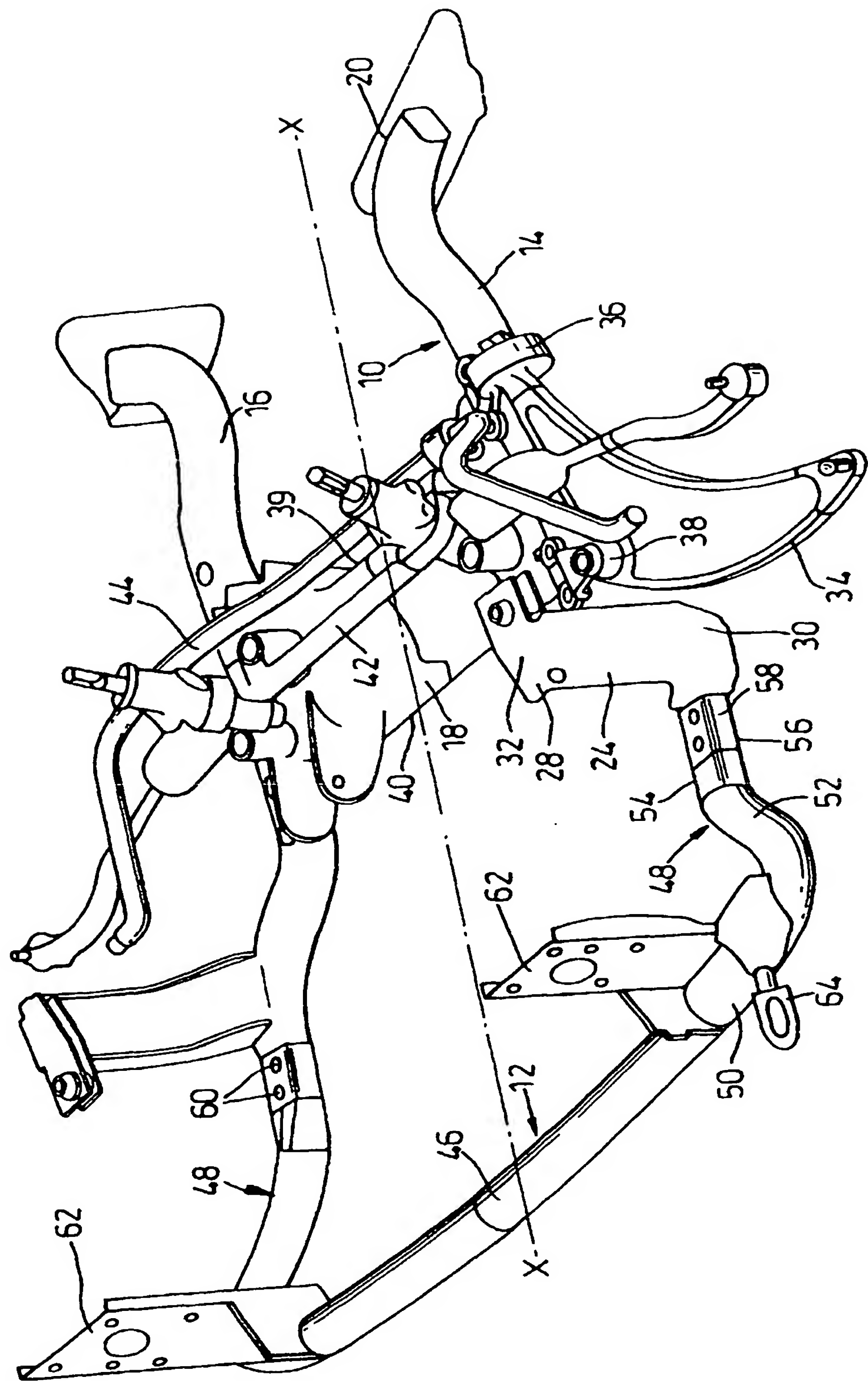
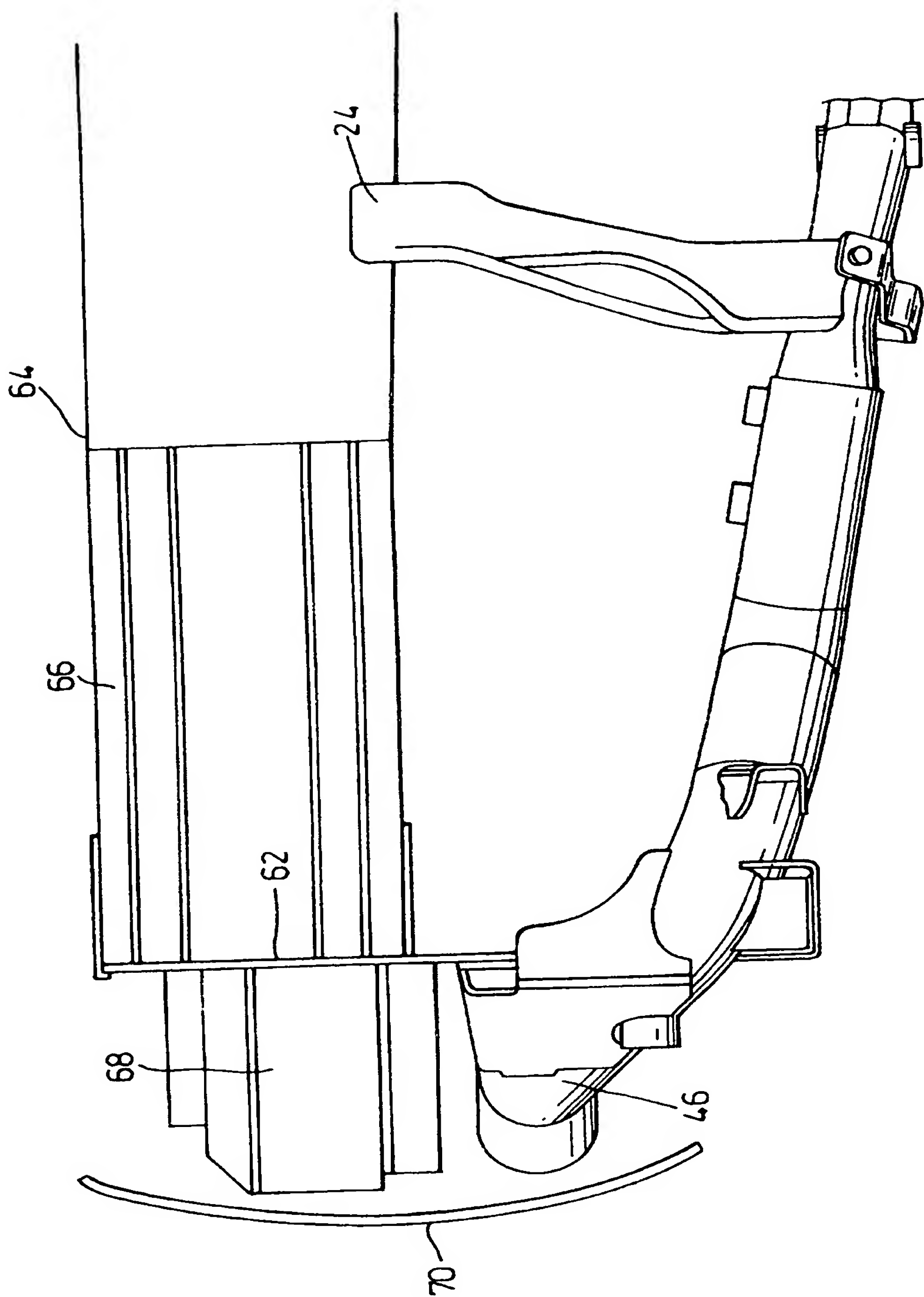


Fig. 2



*Fig. 3*

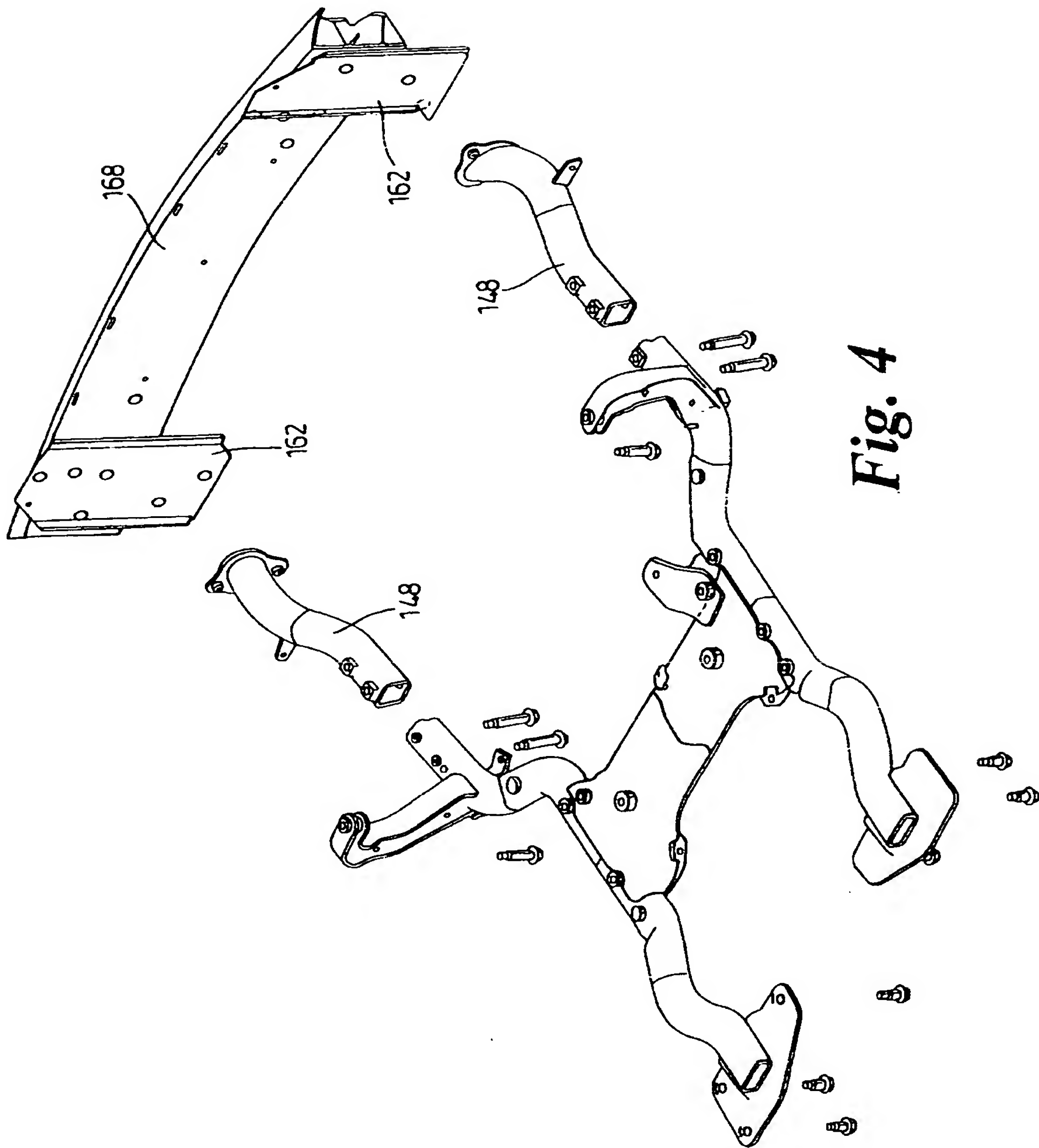
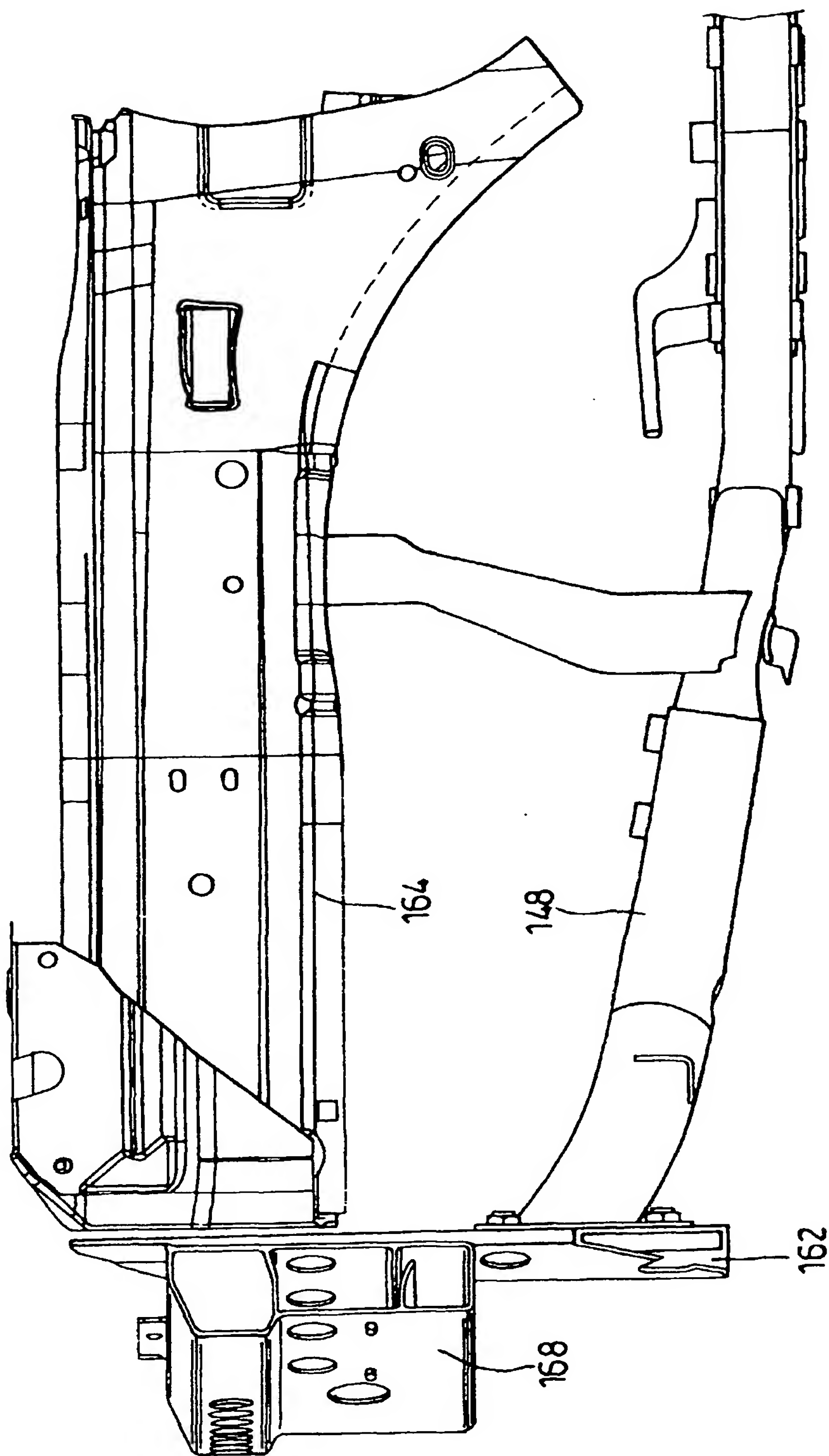


Fig. 4



**Fig. 5**